

## Efficiency and Air Quality Implications of Distributed Generation and Combined Heat and Power in California

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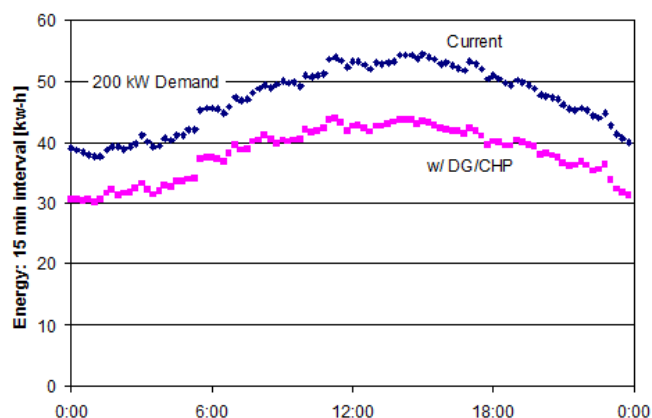
### Fact Sheet

#### The Issue

Distributed generation generates electricity from many small energy sources near where the electricity is used. The use of distributed generation in urban areas, however, can potentially increase exposure to air pollutants. When distributed generation is efficiently deployed in a manner that recovers waste heat for heating and/or cooling—called combined heat and power—negative environmental impacts can be decreased.

Distributed generation/combined heat and power has been identified as a potentially significant and desirable source of electricity in California's future that will help ensure power stability, supply, cost competition, and compliance with climate change protocol. The use of small and mid-sized distributed generation with combined heat and power in the state is expected to grow significantly between now and 2020 for two reasons: 1) ongoing policy and legislation directed at enhancing the stability of California's electricity supply, and 2) meeting goals pertaining to global climate change mitigation.

Information on electrical and thermal load demands is needed to determine accurately the efficiencies and emissions of various applications of distributed generation/combined heat and power systems to aid in optimal system design and placement. Most distributed generation/combined heat and power efficiencies, however, are currently



Energy demand and potential for DG/CHP on a typical day at a grocery store in Southern California.

Source: California Energy Commission Contract 500-02-004 MAQ 07-01

based on theoretical or averaged information, which is not adequate for estimating impacts.

#### Project Description

This project is investigating the efficiencies of distributed generation power combined with heating and cooling usage. Specific market sectors were identified as having the highest potential for wide-scale urban implementation of distributed generation/combined heat and power in the near future.

The most likely and ideal candidates for the successful deployment of mid-sized distributed generation/combined heat and power applications include these six market sectors: commercial/industrial buildings, health care facilities/hospitals, universities/colleges, prisons/jails, hotels, and grocery distribution facilities/supermarkets.

Continuous information on the electrical, heating, and cooling usages is being collected at these facilities.

Measurements on the use of electricity, heat, and gas are being recorded for one year on approximately 100 facilities to determine the potential for installing distributed generation with combined heat and power in the most efficient manner. In addition, the overall use and efficiency levels estimated in this study will be compared with the efficiencies used for calculating emissions credits for combined heat and power units installed in California. Air quality impact assessments and exposure rates are also being estimated.

The goals of this project are to:

- Measure the long-term air quality and energy impacts of the widespread placement of distributed generation/combined heat and power in California urban areas.
- Analyze the efficiencies and emissions of various applications of distributed generation/combined heat and power systems to aid in optimal distributed generation/combined heat and power system design and placement.

## **PIER Program Objectives and Anticipated Benefits for California**

This project supports California's goal of encouraging the development of environmentally sound distributed generation/combined heat and power resources and projects. The research also supports California's goal to account for the environmental impacts associated with energy production, planning, and procurement. This research will provide policy makers with the information needed to understand the value of combined heat and power and will help to better determine the amount of emissions credits to

allocate toward combined heat and power units.

The engineering needs for the effective application of distributed generation will be better defined, which will help the distributed generation and associated combined heat and power industries provide improved products for meeting California's electricity generation goals. Improved methods of emissions modeling for this electricity source will result in more accurate estimates of air pollution emissions, leading to better attainment measures.

Better attainment measures, in turn, will result in more effective mitigation plans for air quality and near-source exposure impacts. California residents will benefit by improved air quality and a reduction in adverse health impacts associated with air pollution, including reduced health care costs.

## **Project Specifics**

Contract Number: 500-02-004 MAQ-07-01

Contractor: UC Irvine

City/County: Irvine/Orange County

Assembly District: 70

Senate District: 35

Application: Statewide and limited national

Contract Amount: \$799,999

Contract Term: December 2003 to March 2011

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